ATLANTIC MENHADEN . . . A MOST ABUNDANT FISH

The Atlantic menhaden, *Brevoortia tyrannus,* is a herringlike fish commonly called mossbunker, bunker, pogy, and fatback. Sometimes it is called alewife and shad, though these last two are the common names of other fishes. One of the most abundant fishes found along the Atlantic coast, the Atlantic menhaden ranges from Maine to Florida.

An Industrial Fish

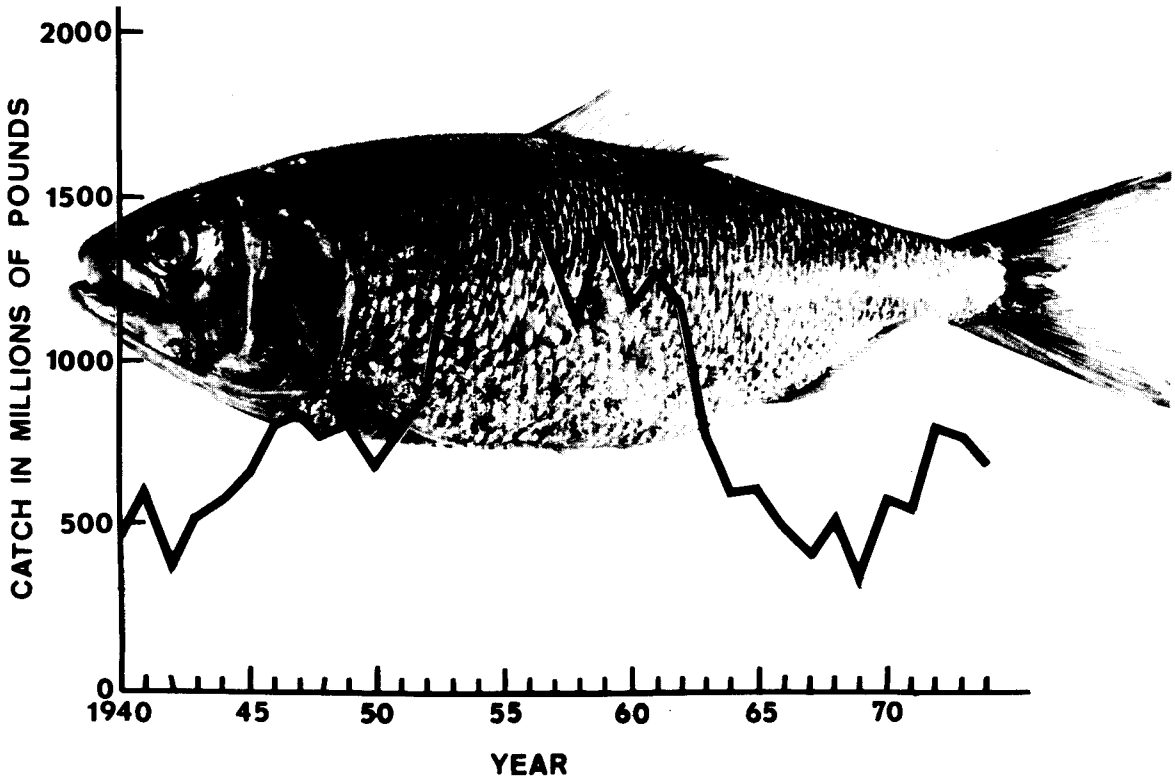
Menhaden are not usually eaten directly by man but are processed into meal, oil, and condensed soluble proteins. The meal and condensed solubles are rich in protein and make an excellent food supplement for poultry, swine, and cattle. The oil is used in various industrial products including paints, soaps, and lubricants and is exported to Europe to be made into margarine.

Menhaden Tops All Other Fish

The Atlantic and Gulf menhaden compose about 40 percent of the nearly 5 billion pounds of fish and shellfish caught annually by U.S. fishermen. Prior to 1963, most of the U.S. catch was made along the Atlantic coast but since then the Gulf menhaden, *Brevoortia patronus,* a similar species caught in the Gulf of Mexico from Florida to Texas, has contributed the greater part.

Fishery Is Modern and Efficient

Carrier vessels, which may range in length from 80 to 200 feet and hold from 125 to over 700 tons of fish, are fast and efficient. Most carry two 36-foot purse boats and a purse seine that is about 1,200 feet long and 60 feet deep. Half of the seine is loaded on each purse boat. When a school of menhaden



MARINE RESOURCES OF THE ATLANTIC COAST

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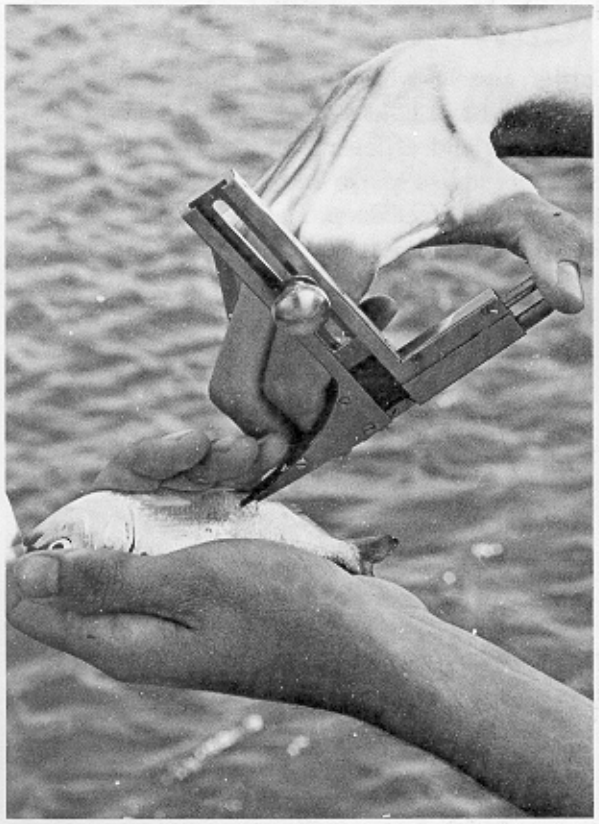

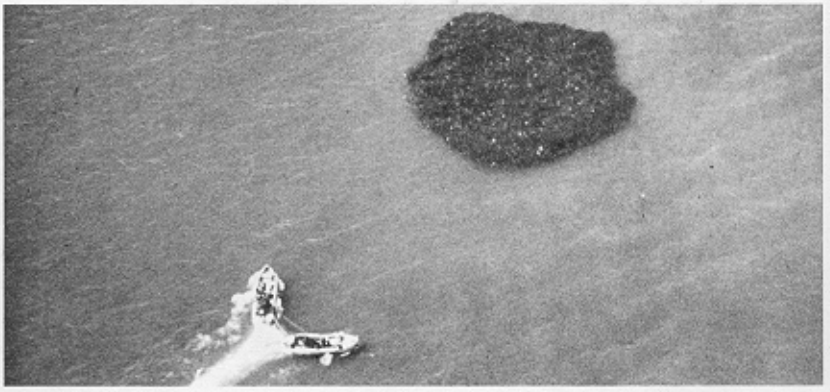

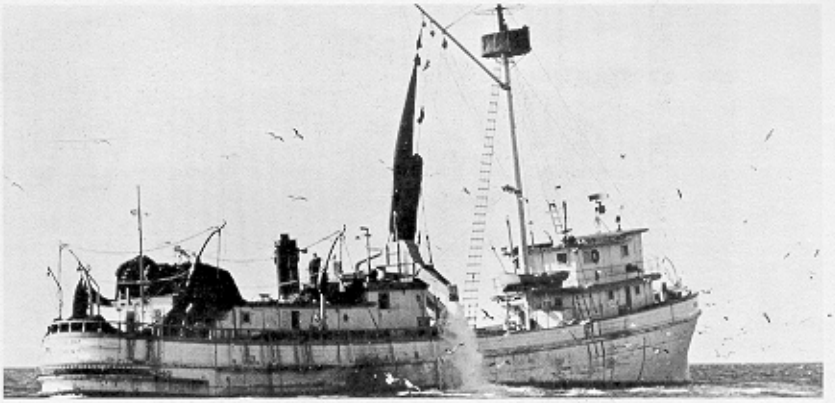

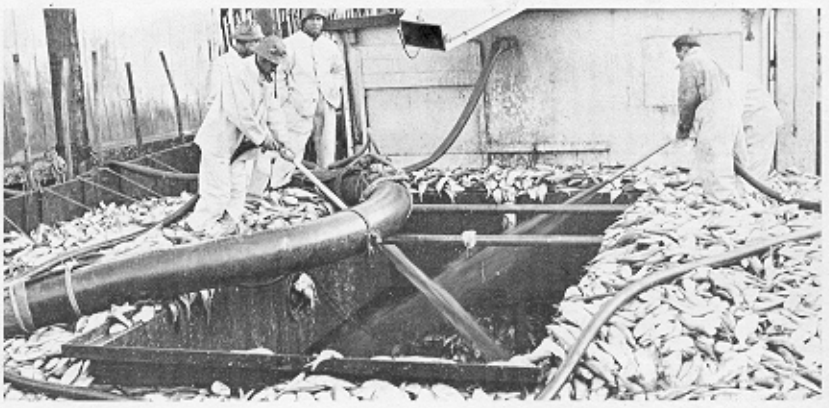

Clockwise from top; 1) A school of Atlantic menhaden feed by swimming with mouths agape to filter plankton from the seawater. 2) After spotting a concentration of feeding menhaden from the air, purse boats begin to encircle the school with a giant 1,200 foot net. 3) The carrier vessel pumps the menhaden into the hold as the purse seine is hoisted to concentrate the fish. 4) Workers unload a deck full of menhaden by adding water and pumping the fish into the reduction plant. *(Above)* A researcher inserts a metal tag into the body of a yearling menhaden.

Photo by Hall Watters, Standard Products Co., Southport, NC

is sighted, the boats are lowered and begin circling the school in opposite directions, letting the net out to surround the fish. When the boats meet, the bottom of the net is closed, or pursed, and the fish are trapped. The net is then pulled into the boats until the fish are concentrated enough for the carrier vessel to move alongside and pump them into the hold. Efficiency has been increased during the past 20 years by using airplanes to spot schools and to direct the setting of the net by radiotelephone. Other new improvements include strong synthetic fiber nets, hydraulic power blocks to pull the net after the set is complete, high-capacity suction pumps to transfer the catch, aluminum purse boats which are light and maneuverable, and refrigerated carrier vessels.

Fishing is Seasonal

Purse seining for menhaden along the Atlantic seaboard usually starts in April in Florida and the Carolinas and later in the year farther north. Purse seining is prohibited in the Maryland section of Chesapeake Bay but is allowed by law in the Virginia section from the last Monday in May to December 18. Fishing usually begins in early June off New Jersey and New York but often not until late June or early July in the Cape Cod area. Fishing in most areas slows down in October.

Historically, there was a fall fishery off the North Carolina coast from Cape Hatteras to Cape Fear that extended from November to early January. Since 1971, however, no large concentrations of adult menhaden have appeared in this area during the autumn. The North Carolina fall fishery has diminished except for catches of juveniles consisting of many individuals that constitute relatively small tonnages.

From Ocean to Estuary and Return

Atlantic menhaden spawn in the ocean over the Continental Shelf and to some extent in the larger, more saline bays and sounds. Spawning occurs at some place along the Atlantic coast every month of the year; April to October from New Jersey northward and from November to March from Delaware to Florida. Most of the spawning takes place during the late fall and winter months along the middle and south Atlantic States. An individual female may spawn from 40,000 to 700,000 eggs, depending on her size and age.

After fertilization, the eggs float near the surface and hatch in about 2 days. The larvae enter the estuarine nursery areas when they are about 1-inch long and eventually move into the tributaries near the upper limits of salt water. Here they transform from slender, transparent individuals into deep-bodied juveniles resembling adult menhaden. From the time of entry early in the year until autumn, when seasonal chilling of the water apparently causes a general exodus, about 8 months are spent in the shallow, inshore nursery areas. Some juveniles may overwinter in the sounds and bays along the south Atlantic coast, particularly during mild winters. Yearlings and adults usually are associated, throughout the year, with the nearshore oceanic waters or in the larger and more saline bays and sounds.

Feeding Habits Change

When menhaden metamorphose from larvae to juveniles they undergo extensive changes in their feeding and digestive structures that affect their feeding habits. Larvae feed by selecting individual planktonic animals. Juveniles and adults, which have gill arches that support a basketlike sieve of gill rakers capable of retaining very small organisms, feed by non-selectively filtering both planktonic plants and animals from the water as they swim with mouths agape.

Seasonal Migrations

Atlantic menhaden of all ages migrate seasonally along the coast; northward in the spring and southward in the fall. The young-of-the-year usually leave the estuarine nurseries in the fall and also move southward along the coast. Most menhaden winter in the offshore waters from Cape Hatteras to Northern Florida. In spring the larger and older fish migrate farther northward than the smaller and younger ones, resulting in the population being stratified by age and size along the coast throughout the fishing season. More than a million Atlantic menhaden were marked with internal ferromagnetic tags from 1966 to 1969 and over 200,000 tags were recovered. Movements of tagged fish confirmed our inferences on movements drawn from changes in age and size

of fish in the catches, and also confirmed that there is only one population of Atlantic menhaden.

Growth and Age

Atlantic menhaden grow rapidly during the first 3 years of life. On the average, they weigh about one-half pound as 1-year-olds, nearly a pound as 2-year-olds, and then grow less each year until they reach a weight of about two pounds and are 6 or 7 years old. The 1- and 2-year-olds make up the bulk of the catch, mainly from Chesapeake Bay and nearby oceanic waters from New Jersey to North Carolina. Individuals over 2 years of age are caught in more northern waters and off North Carolina in the fall.

Population Changes are Important

By 1969, the stock size of the Atlantic menhaden had decreased to about one-fifth of what it had been during the mid 1950's and the average age of the fish had declined. Prior to the decline in stock size, fish of spawning age, 3 to 8 years old, had composed a substantial part of the population. By 1969, fish, age 2 and younger, constituted nearly the entire population. Without large numbers of older fish in the population, fluctuations in abundance associated with variations in year-class strength became more pronounced. Since 1969, the population has increased as several relatively good year-classes have appeared, apparently responding to reduced fishing effort and favorable environmental conditions. While catches have improved, older fish in the population are still relatively scarce and the fishery depends mostly on age-1 and -2 menhaden.

Is There a Need For Management?

Increased mortality due to fishing and the decline in Atlantic menhaden production have raised questions pertaining to overfishing and the need for management. Current research is directed at providing information needed to answer these questions. Because menhaden occupy estuarine nurseries in all coastal Atlantic States, may be caught off one State and processed in another and are vulnerable to foreign fishing, management regulations must be coast wide and not restricted to small local areas if they are to be effective. Our present knowledge of the purse-seine fishery and the dynamics of the Atlantic menhaden population is sufficient for some management action. A State-Federal management plan could be beneficial towards long-term national utilization of the menhaden resource.

Research is Intensive

The Federal government, through the National Marine Fisheries Service, a part of the National Oceanic and Atmospheric Administration, and its predecessor agency, the Bureau of Commercial Fisheries, has been studying the Atlantic menhaden since 1955. The investigations, based at the Atlantic Estuarine Fisheries Center, Beaufort, NC have included studies on menhaden life history, population structure, movements, mortality, the impact of fishing on population structure and abundance, causes of fluctuations and the development of statistical methods to predict changes in abundance. State agencies and universities have also conducted research that has contributed to our knowledge of the resource. The Virginia Institute of Marine Science, Gloucester Point, VA, has studied menhaden in the purse-seine and pound-net fisheries in Chesapeake Bay since the early 1950's. Their work is principally concerned with early development and growth in the bay and nearby ocean.

John W. Reintjes
Robert B. Chapoton
William R. Nicholson
William E. Schaaf

Atlantic Estuarine Fisheries Center
National Marine Fisheries Service
Beaufort, NC 28516